**IN THE UNITED STATES PATENT & TRADEMARK OFFICE**

TITLE

# SYSTEM AND METHOD FOR MANAGING A PLURALITY OF CALLS

INVENTORS

**OSCAR A. MARTINEZ**
**EDUARDO T. SANCHEZ**

# BACKGROUND OF THE INVENTION

## Technical Field

This invention relates generally to systems and methods for managing telephone calls within a network. More particularly, the invention relates to a system and method for managing a plurality of calls between two nodes, typically a media gateway and a media gateway controller.

## History of Related Art

Current telecommunication network architectures include a single node, such as a Mobile Switching Center (MSC), which acts as a combination call gateway and gateway controller. In this single node system, information about the state of telephone calls managed by the node is shared within the node among various components, which include hardware devices, hardware control modules, and call control modules. Figure 1 illustrates a schematic block diagram for this type of prior art gateway/gateway controller combination node **10**.

The prior art combination node **10** includes a call control module **60** in electronic communication with a hardware control module **50**. Several hardware devices **20, 30**, and **40**, such as voice trunks, announcement machines, switching modules, etc. are directly controlled by the hardware control module **50**. In this prior art configuration, wherein the combination node **10** is typically embodied by a MSC, all of the information related to calls and their status is shared between the call control module **60** and the hardware control module **50** using internal software communication methods well known in the art.

Communications standards change rapidly. Newer standards may require separation of the control functions module **70** within a telecommunications node from the hardware functions module **80** within the node. Typical of such standards is the International Telecommunications Union Telecom Standards Sector (ITU-T) recommendation H.248 (incorporated herein by reference in its entirety), which defines the communications protocol used between elements of such a physically decomposed multimedia gateway. While simple communications between the control functions **70** and hardware functions **80** have been generally defined, methods and systems to handle specific events which occur during operation of the functional elements **70, 80** have not been addressed.

For example, assuming that the control functions module **70** is represented by a media gateway controller and the hardware functions module **80** is represented by a media gateway, as described in the ITU-T recommendation H.248, several operating scenarios arise which are not addressed by the protocol recommendation. These include circumstances surrounding a single call outage, a small restart operation, and a large restart operation.

The single call outage situation occurs when the hardware functions module **80** experiences a fault due to a particular call. The hardware functions module **80** typically acts to release the call, but fails to inform the control functions module **70** with regard to the call release activity.

Another event, often caused by software faults detected within the hardware functions module **80,** is a small restart operation. This occurs when the hardware functions module **80** experiences a fault during the setup phase of a single call. The module **80** experiences the fault, but is unable to determine precisely which call (out of a plurality of calls handled by the module **80**) is responsible for the fault. Therefore,

all of the calls handled by the hardware functions module **80** (which are still in the setup phase) are released by the module **80**.

Finally, another operation which may arise within the hardware functions module **80** is a large restart. This can occur when the hardware functions module **80** detects a fault related to one of a plurality of calls it is handling. However, the hardware functions module **80** is unable to determine precisely which call is responsible for the fault, and is also unable to determine which phase is operative (i.e., the setup phase or the through-connected phase) for the faulty call. While the control functions module **70** is informed of the fault, all of the calls must be released by the hardware functions module **80**.

Thus, while a prior art combination node **10** is able to share information between the call control module **60** and the hardware control module **50**, separating the node **10** into functional elements **70, 80**, as required by various standards, leads to diminished ability to distinguish and efficiently handle various operational scenarios. More specifically, while there may be several levels of faulty behavior within the hardware functions module **80**, only the most egregious (i.e., a large restart operation) is communicated from the hardware functions module **80** to the control functions module **70**.

Therefore, what is needed is a system and method for managing a plurality of calls between separated functional elements, such as a first node (e.g., a control functions module, or a media gateway controller) and a second node (e.g., a hardware functions module, or a media gateway). Such a system and method should operate to record the existence of calls handled within the second node, and especially, to record an indication of whether each call has entered the through-connected phase. Further, call outage fault detection and small restart operations should be fully communicated to the

first node by the second node as they arise. Such a system and method would allow the first and second nodes to operate with increased effectiveness.

## SUMMARY OF THE INVENTION

The invention includes a system adapted to manage a plurality of calls including a first node, such as a media gateway controller, in electronic communication with a second node, such as media gateway. The first node includes a memory for receiving messages from the second node regarding through-connections and restart operations. The memory is used to make a record of calls made to the second node, along with indications of through-connections which occur for each of the calls.

The second node typically includes a plurality of resources, of which at least one is dedicated to one or more calls selected from the plurality of managed calls. Announcements of call outage faults, or restart operations, are sent from the second node to the first node as they occur, and dedicated resources are released as needed.

The invention also includes a method of using a first node to manage a plurality of calls maintained by a second node. The method comprises the steps of connecting a call selected from a plurality of calls to provide a through-connection at the second node, receiving a message at the first node announcing the through-connection, and making a record of the call, including an indication of the through-connection at the second node in the memory of in the first node. As noted above, the first node may be a media gateway controller, and the second node may be a media gateway.

The method may further include the steps of receiving a message announcing a single call outage for a call maintained by the second node, and releasing resources dedicated to the call. Typically, these resources are software program module resources, and at least one resource is dedicated to the call to be released. Typically, the

method also includes the steps of detecting the call during its setup phase and making a record of the call in the memory of the first node without any indication that a through-connection has been made for the call (within the second node).

The method may be further augmented by detecting other calls during their setup phases, making records of the calls in the memory, receiving a message announcing a restart operation within the second node, and examining the call records to determine which of the other calls does not include an indication that a through-connection has been made for the call. Those calls without recorded indications of through-connections are then released.

Finally, the messages used to announce through-connections and call outage faults may be NOTIFY messages, such as those described in the ITU-T recommendation H.248. The message announcing a restart operation may be a SERVICE CHANGE message, also described in the H.248 recommendation.

## BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the structure and operation of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings, wherein:

FIG. 1, previously described, is a prior art schematic block diagram of a combination node;

FIG. 2 is a schematic block diagram of the system of the present invention; and

FIG. 3 is a network signal flow diagram illustrating the method of the present invention.

## DETAILED DESCRIPTION OF PRESENTLY PREFERRED EXEMPLARY EMBODIMENTS

Figure 2 is a schematic block diagram of the system **100** of the present invention. The system **100**, adapted to manage a plurality of calls, includes a first node **110**, such as a media gateway controller, and a second node **120**, such as a media gateway. The first node **110** includes a memory **150** in which records **160** of calls are recorded. For example, the memory **150** may include a first call record **170**, a second call record **180**, and an $N^{th}$ call record **190**. Records **160** of the calls, which may or may not be through-connected, are recorded in the memory **150**, along with an indication of whether the call is through-connected. For example, in Figure 2, the first call record **170** includes an indication **200** of a through-connection for a call. The second call record **180** has been recorded without an indication **210** of a through-connection for a second call. Finally, the $N^{th}$ call record **190** has been recorded along with an indication **220** of a through-connection for the $N^{th}$ call. Thus, the indications **200, 220** of call through-connections in the records **160** of the calls may be software flags which are "set" to indicate that a through connection has been made for the first and $N^{th}$ calls. Of course, if no through-connection has been made for a particular call, then the record **160** may be recorded in the memory **150** without any indication of the through connection for that particular call (e.g., the call record **180** has been recorded without any indication **210** of a through-connection for the second call).

The first node **110** is in electronic communication with the second node using a network **130**, such as a global telecommunications network, e.g., the Internet. The first node **110** may also be connected to the second node **120** in a more direct

fashion, using a wire line **140**, which is equivalent to, or identical to, a wired connection, a fiber-optic connection, or a wireless connection.

The second node **120** is responsible for receiving a plurality of calls as they are set up (i.e., during the setup phase) and making through-connections for the calls as needed. The second node **120** also sends messages to the first node **110** regarding calls received, through-connections which have been made, call outage faults, and restart operations. Such messages may take the form of NOTIFY messages, or SERVICE CHANGE messages, as described in the ITU-T recommendation H.248 (described below). The second node includes a plurality of resources **240**, including resources which may be dedicated to one or more of the calls. For example, the second node **120** may include a first resource **250**, a second resource **260**, and an $N^{th}$ resource **270**, dedicated to a first call, a second call, and an $N^{th}$ call, respectively.

Figure 3 is a network signal flow diagram illustrating the method of the present invention. The various components shown are identical to, or similar to, the system **100** (having a media gateway controller **110** and a media gateway **120**) shown in Figure 2, whose elements are connected by a network **130**. In the exemplary scenario illustrated in Figure 3, a first calling party **280** makes a first call **300** to the second node **120** at step **300**. The first call is detected within the second node **120** at step **305**. A message containing the identity of the first call is then sent from the second node **120** to the first node **110** in step **310,** after the first call has been detected during its setup phase within the second node **120**. Between steps **310** and **330** there are several other actions which may be taken to establish the call, well known to those skilled in the art, but they

are not relevant to the method, and are therefore not discussed herein. After receiving the message in step **310**, the first node **110** records a record **170** of the first call in its memory **150** at step **320,** including an identification number for the first call. This record will be made without any indication of a through-connection for the first call in the second node **120**. However, after the first call is through-connected within the second node **120** at step **330**, a message will be received by the first node **110** announcing the first call through-connection at the second node **120** in step **340**. After receiving the through-connect message, the first node **110** will search the records in the memory **150** to determine whether the first call record exists in step **350**. Since a record **170** was indeed recorded in step **320**, then the indication **200** of a through-connection for the first call can be made in the first call record **170**. The indication is typically realized as a flag that is "set". In the event that no record is found to correspond with a through-connected call identification number, then that call corresponding to the through-connection message of step **340** will be released. The through-connection message of step **340** may take the form of a NOTIFY message, as described in the ITU-T recommendation H.248. Finally, the record **170** of the first call, including an indication **200** of the first call through-connection at the second node **120** will be recorded in the memory **150** of the first node **110** at step **350**.

Subsequent calls, such as a second call from a second calling party **290,** may be made at step **355** and detected during its setup phase within the second node **120**, as is shown at step **357**. After detection at step **357**, a message is received at the first node **110**, containing the identity of the second call in step **360**. After step **360**, there are

several other actions which may be taken to establish the call, well known to those skilled in the art, but these are not relevant to the method described herein. Then, in step **365**, the method continues by recording a record **180** in the memory **150** of the second call (without any indication of a second call through connection), using the identification number of the second call.

At this point, several different types of events may occur, such as a single call outage (wherein the fault can be traced to a particular call during the setup phase), or faults which are detected by the second node **120** which in turn is unable to determine that a particular call caused the fault, and/or is unable to determine the phase of the faulty call (i.e., setup phase or through-connection phase).

In a first scenario, a fault may be detected wherein the second node **120** is able to determine the particular call which is faulty, as well as the fact that the faulty call is in its setup phase. This occurs in step **370**. Given these conditions, the first node **110** may receive a message announcing a single call outage for the second call. For example, after detecting the fault in step **370**, the second node **120** can send such a message indicating the nature of the fault in step **380** to the first node **110**. This message may be in the form of a NOTIFY message, as described in the ITU-T recommendation H.248. After the message indicating a call outage event is received by the first node **110** in step **380**, the resources dedicated to the second call may be released by the second node **120** in step **390**. Thus, out of the plurality of resources **240** (such as software program module resources) included in the second node **120**, a second resource **260** dedicated to the second call made in step **357** can be released in step **390**.

Another possible fault condition is one leading up to a restart operation within the second node **120**. For example, in a second scenario, the second node **120** may experience a fault during the setup phase of one or more calls. However, the precise call which is faulty cannot be determined. This may occur at step **400**, wherein a fault within the second node **120** requiring some type of restart operation is detected. In this case, a message will be received by the first node **110** announcing a restart operation within the second node **120** in step **410**. This message may take the form of a SERVICE CHANGE message (described in the ITU-T recommendation H.248) wherein the designated "method" is a "small restart". At this point, the first node **110** will examine the call records to determine which calls have been recorded with no indication of being in a through-connected phase. For example, in Figure 3, the indication **200** of a through-connection for the first call exists in the record **170** in the memory **150** of the first node **110**. However, there is no indication **210** of the second call through-connection in the record **180** of the second call in the memory **150** of the first node **110**. After the call records **170, 180** are examined in step **420**, the second call will be released. Thus, all calls that do not have an indication of a through-connection will be released during the restart operation **430** of the second node **120**.

Although the invention has been described with reference to specific embodiments, this description is not meant to be construed in a limited sense. The various modifications of the disclosed embodiments, as well as alternative embodiments of the invention, will become apparent to persons skilled in the art upon reference to the

description of the invention. It is, therefore, contemplated that the appended claims will cover such modifications that fall within the scope of the invention, or their equivalents.